Massachusetts Institute of Technology
Department of Aeronautics and Astronautics
Cambridge, MA 02139

16.01/16.02 Unified Engineering I, II
Fall 2006

Problem Set 1

Name: _____

Due Date: 9/12/2006

	Time Spent (min)
U1	
Study Time	

Announcements:

16.001/16.002 – Unified Engineering
Fall Semester 2006
Homework Problem U1

(a) Consider an aircraft in level, horizontal flight at constant speed. Derive an expression for the endurance and range for this aircraft. State all assumptions required to obtain your answers. Show all diagrams used in your modeling. What are the primary limitations of your model? Compare your analysis and results with that presented in the first Unified Engineering lecture (Breguet range equation). Show details of solving differential equations that you derived in your modeling.

(b) Using the results derived in class,

$$RANGE = \frac{h}{g}\left(\frac{L}{D}\right)\left(\eta_{overall}\right)\ln\left\{\frac{W_{initial}}{W_{final}}\right\}$$

show how range varies as a function of $\{W_{initial}/W_{final}\}$ for fixed h and (L/D) and five values for $\eta_{overall}$ = (0.90; 0.80; 0.70; 0.60; 0.50).

(c) Show how range varies as a function of (L/D) for fixed h and $\eta_{overall}$ and six values for $\{W_{initial}/W_{final}\}$ = (1.5; 2.0; 2.5; 3.0; 3.5; 4.0).

(d) Discuss/explain your results in parts (b) and (c).

END